Agricultural and Financial Market Interdependence: Another View

Agricultural and Financial Market Interdependence: Another View

Michael T. Belongia
Federal Reserve Bank of St. Louis
84-012

Dallas S. Batten and R. W. Hafer made constructive comments on earlier drafts of this manuscript. The views presented do not necessarily represent those of the Federal Reserve Bank of St. Louis or the Board of Governors of the Federal Reserve System. All remaining errors are the responsibility of the author.

Agricultural and Financial Market Interdependence: Another View

Empirical estimates presented by Chambers offer the most recent argument that restrictive monetary policy has significant negative effects on farm income, net agricultural exports and relative prices of farm products at the retail level. It is our view, however, that this study, and a considerable proportion of the previous evidence linking monetary policy to fluctuations in agricultural income, prices and trade are based on a fundamentally inappropriate application of static comparisons to problems of dynamic adjustment. Consequently, standard hypotheses of monetary economics are misinterpreted and judgments about the effects of restrictive monetary policy often are incorrect. While Chambers' recent article is the motivation for this note, our more general purpose is to review and clarify what we believe are persistent errors in the application of monetary theory to issues in the agricultural sector.[1/]

Following the main points in Chambers' paper, we limit the discussion to three issues. First, we posit that the dynamic influences of monetary policy need to be examined in the context of growth rates--not levels--of monetary aggregates. Second, even though Chambers admits his model is short-run in nature, we discuss why the issue of money neutrality is relevant only with respect to long-run changes in variables. Finally, we find that specifying variables in growth rates produces results in substantial disagreement with those reported by Chambers and found in other similar studies.

LEVELS VERSUS GROWTH RATES IN MONETARY ANALYSIS

The problem with models that use levels of money stock can be isolated quickly if several basic propositions are understood. First, recall that the quantity theory expresses the domestic rate of inflation as $\dot{P} = \dot{M} + \dot{V} - \dot{y}$, where dots over variables represent rates of change and P, M, V and y represent, respectively, the aggregate price level, money, velocity and real income. Second, if short-run variations in real income and velocity from their trend paths and the consequent transitory effects on real values are ignored, the quantity

theory expression for inflation hypothesizes that (a) there is a one-to-one long-run correspondence between the rate of inflation and money growth and (b) inflation has no long-run effects on real magnitudes (i.e., money is neutral). Both propositions have been supported generally (see Friedman and Schwartz for a survey) and with respect to agricultural prices (Belongia and King). Third, a monetary analysis of exchange rates links changes in this relative price of two currencies to changes in the differential between expected rates of inflation in those two countries (e.g., Mussa).

With this as background, consider an analysis of exchange rates and agricultural trade based on levels of the money stock. A 10 percent reduction in the level of the money stock during one year would be a 17 percent reduction in the annual rate of money growth from the current trend path of M1. Moreover, the quantity theory would predict further 10 percent annual domestic deflations in all subsequent years this policy was followed. Therefore, if the rates of inflation in other countries were zero, the dollar would be expected to appreciate 10 percent per year under this type of monetary policy; the appreciation of the dollar would

be larger, of course, if foreign rates of inflation were positive. However unrealistic this outlook for domestic monetary policy and inflation might seem in comparison with historical data, this is exactly the type of policy simulated in a number of studies of money's influence on agriculture.[2/]

The misleading nature of the estimated effects of "restrictive" monetary policy on agricultural trade and prices might be seen more clearly, however, if this definition of restrictive policy is compared to actual data trends. Between 1970 and 1983, M1 grew at an average annual rate of 6.9 percent; since 1976, M1 has expanded at a 7.7 percent rate. The level of M1 has not declined (Chambers' definition of tight monetary policy) since 1933. Simulations based on reductions in the level of a monetary aggregate impose a money growth path consistent with The Great Depression but wholly at odds with recent experience. These comparisons illustrate why representing the dynamics of monetary policy in growth rate form offers interpretations of real world adjustments and policy prescriptions substantially different from those based on static comparisons in which the Fed, through lumpy and periodic open market operations changes the level of the money stock in a once-and-for-all manner.

TESTING NEUTRALITY: NOMINAL VERSUS REAL MAGNITUDES

Neutrality of money typically is taken to mean that the growth rate of the nominal money stock has no long-run effects on velocity, real income and relative prices. This proposition can be tested in two ways. Writing $\dot{Y}_t = \alpha_o + \sum_{i=0}^{k} \beta_i \dot{M}_{t-i} + A^{-1}(L)X + \varepsilon_t$ where Y_t is some dependent variable expressed as a function of a distributed lag of money growth ($\dot{M}$), a distributed lag of other variables (in matrix X) and a random error term (ε_t), money is neutral if, for Y_t expressed in real terms, $\sum_{i=0}^{k} \beta_i = 0$.

Chambers reports, however, that money is non-neutral because reductions in the level of money reduce relative farm prices and farm income. Aside from the previous comments regarding tests of this hypothesis in terms of data levels, his analysis can be questioned for at least two other reasons. First, his figure 2 suggests permanent increases in both relative farm prices and nominal income even though his discussion (without empirical justification) concludes that the effects are negative. Second, because the analysis is short-run in nature, Chambers never tests the necessary long-run neutrality proposition that the cumulative sum effect of money growth on relative prices and nominal income should

be equal to zero and one, respectively.[3] From the incomplete and, apparently, contradictory evidence found in Chambers' figure 2 and elsewhere, his conclusion that restrictive monetary policy depresses nominal farm income and relative prices appears unfounded.[4]

NEW RESULTS BASED ON A DATA RESPECIFICATION

Chambers uses vector autoregression techniques to investigate relationships among M1, farm proprietor's income (FI), net agricultural exports (NET) and the relative price of food products (RP); the latter is measured as the ratio of the Consumer Price Index for food to the CPI for all items less food. His reported results can be questioned, however, for at least two reasons. First, vector autoregression is a statistical tool intended primarily for use when the researcher admits no (or little) a priori knowledge of structural relationships in a model; given the attention to mathematical detail and model structure in the first half of Chambers' article, the use of vector autoregression to estimate relationships seems inconsistent. Second, at least some econometricians claim that, while vector autoregression can improve

forecasts and offer inferences on causal ordering, it is of little use in testing hypotheses regarding structural relationships (e.g., Leamer). For both reasons, the reported empirical relationships between money and agricultural variables and the relatively strong policy prescriptions offered by Chambers seem unfounded. It is our interest, therefore, in testing the robustness of Chambers' results if all nominal variables are expressed in growth rate form.

As a quick check of this proposition we report tests of Granger causality between M1 and the same three agricultural variables used in Chambers' study. Since causality tests are known to be sensitive to the number of lags chosen for right-hand-side variables, models using all combinations of lags--up to a maximum of 12 months--were estimated. The result of this estimation is a 12-by-12 matrix of F-statistics relating to the null hypothesis that some Y_t is caused by some variable, X_t. Although conclusions based on this approach to testing face a number of statistical criticisms (e.g., Lovell), the percentage of significant F's and a pattern of significant F's relating only to specific lag lengths nonetheless provide some insight on the relationship between M1

and the selected agricultural variables. We use the same time series as Chambers of monthly data between May 1976 and May 1982.

With respect to M1 causing farm income or agricultural trade, the conclusion from this testing is uniformly that no statistical relationship exists. None of 144 F-statistics is significant for M1 causing either variable. Similarly, M1 can be judged to cause changes in relative prices in only three of 144 cases. With fewer than 0.1 percent of these F-statistics significant, it appears reasonable to conclude that the growth rate of M1 has little influence on these agricultural variables. These results--based on a data specification consistent with monetary theory--differ sharply from the strong relationships reported by Chambers.

CONCLUSIONS

Recent work by Chambers represents the latest effort to link monetary policy to agricultural variables. His work, however, uses an inappropriate specification of a monetary variable and confuses several fundamental hypotheses of monetary economics. Moreover, his estimation technique is inappropriate for drawing inferences on structural relationships between monetary policy and

agriculture. This work--like much of the previous work on linkages between money and agriculture--offers statistical correlations that are of little practical value for policy prescription.

FOOTNOTES

1/ Other studies finding statistical correlations between levels of agricultural variables and levels of the money stock include Chambers (1981), Chambers and Just (1982).

2/ In earlier work, Chambers (1981) and Chambers and Just found that various agricultural price variables were related statistically to the level of the money stock. The latter study, for example, found that a "sustained ten percent reduction in domestic credit (read: ten percent reduction in the level of M2) eventually evokes more than a seventeen percent change in the level of wheat price, a seven percent change in corn price and an eleven percent change in soybean price (p. 244)." Although Gardner found these estimates "implausible," he never offered a specific reason for this judgment. These estimates are implausible, however, because a simulated 10 percent reduction in the level of M2 is a 20 percent decline in M2 from its trend growth path in the first year and further 10 percent declines in subsequent years. This restrictive pattern of money growth is comparable to the monetary contraction of the Great Depression in which M2 declined at an annual rate of 9.8 percent. Under this type of monetary policy, the fallout from a worldwide depression would overshadow the effects on agricultural prices estimated by Chambers and Just.

3/ In one study where neutrality was tested with respect to the all-food CPI and major commodity groups of the food CPI, Belongia found unanticipated changes in money growth to have non-neutral effects on relative food prices in the first month but to have zero net effect after a three month lag.

4/ One would hypothesize, a priori, a one-to-one negative response of nominal farm income to slower rates of growth of money. Again, from the equation of exchange, $\dot{M} + \dot{V} = \dot{GNP}$; for V stable, slower money growth implies slower growth for nominal GNP. If money is neutral, the growth rate of nominal farm income--a component of nominal GNP--should decline by an amount comparable to the reduction in the growth rate of money. The interesting test, of course, is whether real farm income responds to a change in nominal money balances.

REFERENCES

Belongia, Michael T. "Unanticipated Inflation, Rational Expectations and the Relative Price of Food." Paper presented at the AAEA annual meetings, Logan, Utah, August 3, 1982.

Belongia, Michael T. and King, Richard A. "A Monetary Analysis of Food Price Determination." American Journal of Agricultural Economics. 65 (1983): 131-35.

Chambers, Robert G. "Interrelationships between Money Instruments and Agricultural Commodity Trade." American Journal of Agricultural Economics. 63 (1981): 934-41.

Chambers, Robert G. and Just, Richard E. "An Investigation of Monetary Factors on U.S. Agriculture," Journal of Monetary Economics. 9 (1982): 235-47.

Friedman, Milton, and Schwartz, Anna J. Monetary Trends in the United States and the United Kingdom: Their Relation to Income, Prices and Interest Rates, 1867-1975. University of Chicago Press, 1982.

Gardner, Bruce. "On the Power of Macroeconomic Linkages to Explain Events in U.S. Agriculture," American Journal of Agricultural Economics. 63 (1981): 871-78.

Leamer, Edward E. "Vector Autoregressions for Causal Inference?" Paper presented at the

Carnegie-Rochester Public Policy Conference, April 13-14, 1984, Rochester, N.Y.

Lovell, Michael C. "Data Mining." Review of Economics and Statistics. 65 (1983): 1-12.

Mussa, Michael. "Empirical Regularities in the Behavior of Exchange Rates and Theories of Foreign Exchange Markets" in Karl Brunner and Allan H. Meltzer, eds., Policies for Employment, Prices, and Exchange Rates, Carnegie-Rochester Conference Series on Public Policy. Supplement to the Journal of Monetary Economics 11(1979): 9-57.